CLAIMS

What Is Claimed Is:

1. A photovoltaic module for converting coherent laser radiation from a laser emitting light at a wavelength into electrical power, said module comprising:

(a) a housing having a cavity of generally optimized closed shape inside said housing, said cavity having an internal surface area A_s and including an opening for admitting said laser radiation into said cavity, said opening having an entrance aperture area A_i that is substantially smaller than A_s; and

(b) a plurality of photovoltaic cells within said cavity, said photovoltaic cells having an appropriate bandgap energy to respond to said wavelength and generate said electrical power.

2. The photovoltaic module of Claim 1 wherein each said photovoltaic cell is a single junction cell having a receiving surface on which said laser radiation is incident.

3. The photovoltaic module of Claim 2 wherein each photovoltaic cell is provided with a back surface mirror for reflecting photons not absorbed by a photovoltaic cell on which said photons are incident.

4. The photovoltaic module of Claim 2 wherein said photovoltaic cells have a given quantum efficiency selected to optimize the conversion of said wavelength of said laser.

5. The photovoltaic module of Claim 1 further including a secondary concentrator system for receiving pre-focused said laser radiation from a primary concentrator, secured to said opening.

6. The photovoltaic module of Claim 5 wherein said secondary concentrator includes inner surfaces that are mirrored.

7. The photovoltaic module of Claim 6 wherein said secondary concentrator is a non-imaging, compound parabolic of hollow design.

8. The photovoltaic module of Claim 6 wherein said secondary concentrator has a Bezier optimized contour to provide a combination of maximum acceptance angle, maximum concentration, and minimum height.

9. The photovoltaic module of Claim 5 wherein said secondary concentrator is dielectric and further includes an integral extractor rod for guiding said light towards the center of said cavity and then to emit photons uniformly in all directions to provide angular isotropy of said photons.

10. The photovoltaic module of Claim 1 wherein the ratio of A_i to A_s is 0.01 or less.

11. The photovoltaic module of Claim 1 wherein said photovoltaic cells have an optimized bandgap energy to respond to said wavelength.

12. The photovoltaic module of Claim 11 wherein said photovoltaic cells have a peak of quantum efficiency response matching said wavelength.

13. The photovoltaic module of Claim 1 further including

(a) a plurality of solar cells within said cavity, at least some of said solar cells each having different energy bandgaps so that their spectral responses span at least a portion of the solar spectrum; and

(b) at least one wavelength filter associated with each solar cell, said at least one wavelength filter selected from the group consisting of Rugate filters and a combination of Rugate filters and stack interference filters, thereby providing selective transmission and reflection of incident solar radiation to assist in maximizing ab-

sorption of a region of said solar spectrum by solar cells having an appropriate bandgap.

14. The photovoltaic module of Claim 13 wherein said solar cells are multi-junction solar cells.

15. In combination, a reflecting concentrator and a photovoltaic module for converting coherent laser radiation from a laser emitting light at a wavelength into electrical power, wherein:

(a) said module comprises

(1) a housing having a cavity of generally optimized closed shape inside said housing, said cavity having an internal surface area A_s and including an opening for admitting said laser radiation into said cavity, said opening having an entrance aperture area A_i that is substantially smaller than A_s, and

(2) a plurality of photovoltaic cells within said cavity, said photovoltaic cells having an appropriate bandgap energy to respond to said wavelength and generate said electrical power;

(b) said reflecting concentrator comprises

(1) a primary concentrator for intercepting and concentrating said laser radiation, and

(2) a secondary concentrator for receiving said concentrating said laser radiation from said primary concentrator and further concentrating said laser radiation; and

(c) said photovoltaic module positioned for receiving said further concentrated laser radiation from said secondary concentrator.

16. The combination of Claim 15 wherein said reflecting concentrator comprises a Cassegranian concentrator.

17. The combination of Claim 15 wherein said Cassegranian concentrator comprises as said primary concentrator a parabolic concentrator and as said secondary concentrator a hyperbolic concentrator.

18. The combination of Claim 15 wherein each said photovoltaic cell is a single junction cell having a receiving surface on which said laser radiation is incident.

19. The combination of Claim 18 wherein each photovoltaic cell is provided with a back surface mirror for reflecting photons not absorbed by a photovoltaic cell on which said photons are incident.

20. The combination of Claim 18 wherein said photovoltaic cells have a given quantum efficiency selected to optimize the conversion of said wavelength of said laser.

21. The combination of Claim 15 further including a secondary concentrator system for receiving pre-focused said laser radiation from a primary concentrator, secured to said opening.

22. The combination of Claim 21 wherein said secondary concentrator includes inner surfaces that are mirrored.

23. The combination of Claim 22 wherein said secondary concentrator is a non-imaging, compound parabolic of hollow design.

24. The combination of Claim 22 wherein said secondary concentrator has a Bezier optimized contour to provide a combination of maximum acceptance angle, maximum concentration, and minimum height.

25. The combination of Claim 21 wherein said secondary concentrator is dielectric and further includes an integral extractor rod for guiding said light towards the cen-

ter of said cavity and then to emit photons uniformly in all directions to provide angular isotropy of said photons.

26. The combination of Claim 15 wherein the ratio of A_i to A_s is 0.01 or less.

27. The combination of Claim 15 wherein said photovoltaic cells have an optimized energy bandgap to respond to said wavelength.

28. The combination of Claim 27 wherein said photovoltaic cells have a peak of quantum efficiency response matching said wavelength.

29. The combination of Claim 15 further including means for transferring waste heat from said photovoltaic module to a back surface of said primary concentrator for radiation into the surrounding environment.

30. The combination of Claim 15 further including

(a) a plurality of solar cells within said cavity, at least some of said solar cells each having different energy bandgaps so that their spectral responses span at least a portion of the solar spectrum; and

(b) at least one wavelength filter associated with each solar cell, said at least one wavelength filter selected from the group consisting of Rugate filters and a combination of Rugate filters and stack interference filters, thereby providing selective transmission and reflection of incident solar radiation to assist in maximizing absorption of a region of said solar spectrum by solar cells having an appropriate bandgap.

31. The combination of Claim 30 wherein said solar cells are multi-junction solar cells.